

## Background

In Ireland, 30% of public-private water supplies come from groundwater. Our dependency on groundwater means that we have to look after our existing production wells or boreholes.

A borehole or well is not, in itself, a water source. There is nothing magic about a borehole; which should be regarded as simply an access point or hole to draw upon groundwater flow and storage in the aquifer around the borehole.

A good borehole is one that lets water flow into it easily. In other words, it is an efficient access hole. This efficiency can be measured, by pumping the hole at different rates and measuring the drawdown. It is normal for the efficiency of a borehole to deteriorate with time. There are many, varied reasons for this.

Natural, non-pathogenic bacteria occur in all aquifers and unfortunately can grow as sticky, thick slimes in the pores of a gravel pack and, or, in the cracks in the rock, that let water flow into the hole. A similar process takes place with some minerals in the water. Physico-chemical changes take place when water flows from the aquifer into the hole. Unstable minerals such as Calcite (lime-scale) and iron and manganese can precipitate and form encrustations in the gaps used by the water to enter the hole. Sometimes the bacteria encourage the growth of encrustations.

Pumping draws loose sand or gravel in the aquifer passages towards the hole. These particles can partially block passages in the rock or slots in a well screen. The partial blockages often trap other grains of sand that further reduce the ease with which water can enter the hole through the narrow cracks.

Inappropriate pump operation can also make matters worse. Deep set pumps cycling on and off can create ideal conditions for corrosion, encrustation and biofilms

It is normal international practice to monitor well efficiency and carry out proactive maintenance and rehabilitation of wells on a routine basis. Following International practice will provide substantial savings vis a vis well replacement, increased pumping costs or poor water quality.

## Problems causing a decrease in Well Yield and Efficiency

The yield, efficiency and quality of water from wells can sometimes be affected by changes in the groundwater resource, but are usually caused by physical, chemical and/or biological changes in the borehole or the aquifer immediately adjacent to the borehole. These are often:-

### Chemical

1. Encrustation - forming on well screens
2. Corrosion - failure of well casing allowing fines to enter well and result in sand pumping

### Biological

1. Iron and Manganese biofouling
2. Slime forming bacteria
3. Spore forming bacteria
4. Nitrifying bacteria
5. Sulphur reducing bacteria
6. Anaerobic corrosive bacteria

### Physical

1. Interference of nearby wells
2. Sand movement
3. Erosion of borehole wall
4. Pump degradation and malfunction
5. Aquifer degradation

## Methods of Well Rehabilitation

The rehabilitation of a production borehole usually involves either physical or chemical treatments to repair damage or remove clogging and obstacles preventing efficient flow from the aquifer into the well. All of these procedures require careful competent staff, and specialist equipment. Not all methods are appropriate for all circumstances. It is important to select a methodology on the basis of sound information and assessment.

### Chemical

1. Acids (Muriatic, Sulphamic, Hydroxacetic, Citric)
2. Caustics (Caustic soda)
3. Polyphosphates
4. Chlorine
5. Hydrogen Peroxide
6. Quaternary Ammonium

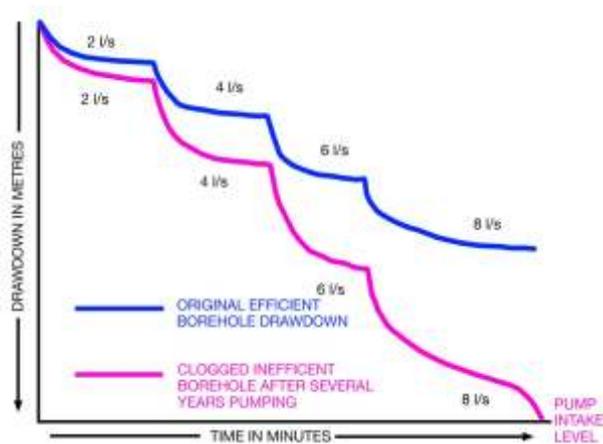
### Physical

1. Jetting
2. Surge pumping and backwashing
3. Swabbing
4. Compressed air surging
5. Explosives
6. Liquid gaseous Carbon Dioxide agitation
7. Dual Air Pipe Eductor System

## Range of services provided by Aquadrill

1. Professional team of drillers, hydrogeologists, technicians and specialist sub-contractors.
2. Hydrogeological tests and assessments before, during and after work has been carried out.
3. Down-hole camera surveys and if necessary borehole geophysics to assess problems.
4. Physical and chemical treatments to improve well efficiency and yield.
5. Installation of new pump chamber casing with cement grout seal to prevent ingress of shallow polluted water, where appropriate with existing well design.
6. Comprehensive pumping test and water analyses.
7. Deeper drilling in existing wells, where appropriate.





## Maintenance Monitoring for Performance and Water Quality

### Early detection of well deterioration

A preventative maintenance/monitoring programme should provide regular analysis to determine whether deteriorating conditions may be occurring, and the reasons for changes in well and pump performance and water quality, as soon as they are detected.

Useful Parameters include: -

1. Hydraulic testing.
2. Microbial; total iron and/or manganese related bacteria.
3. Visual/physical pump and column pipe inspection by CCTV.
4. Physico-chemical parameters; total and ferric iron, pH, turbidity, Carbonate concentration.



## Preliminary Stage

Issues to consider by a combined hydrogeologist drilling contractor team in advance of well rehabilitation.

1. Design of existing well (borehole log and measurements)
2. local chemistry of groundwater
3. local microbiology of groundwater

## Proposal Stage

1. Set out a costed proposal outlining the scope of work and methodology.
2. Establish pre-rehabilitation analyses/ results of water chemistry and microbiology. In addition, establish current well output.
3. Set out anticipated water analyses and pumping output improvement targets.

## Rehabilitation Stage

1. Mobilise comprehensive equipment and machinery operated by experienced and trained personnel, fully insured and compliant to health and safety requirements.
2. Provide supporting professional services including hydrogeologist, laboratory analyst and specialist pumping test contractors.

## Post Well Rehabilitation Stage

1. Survey well improvements to expected well performance targets.



# Water Well Rehabilitation

## Water Supply Borehole Maintenance & Rehabilitation Service

Water Supply Boreholes or wells decline in yield with time. This deterioration usually happens slowly for natural reasons, but can be created, or accelerated, by an inappropriate pumping regime.

The deterioration is not spotted until it is too late; then, often in a crisis, another borehole has to be drilled. Additional drilling is expensive and often involves land acquisition and more tests.

We are now offering a complimentary service to our well drilling and geothermal drilling operations; the assessment, maintenance and rehabilitation of existing wells.

## What You Need To Know

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